Synopsis and Suggestions for Using the

National fish, Wildlife, and Plants Climate Adaptation Strategy

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Synopsis and Suggestions for Using the *National Fish, Wildlife and Plants Climate Adaptation Strategy*

Overview

The *National Fish, Wildlife and Plants Climate Adaptation Strategy* (NFWPCAS or *Strategy*), released in March of 2013,[1] is a framework for coordinated action to safeguard fish, wildlife, and plants and the ecosystem services they provide, in the face of a changing climate.[2] Called for by both Congress and the Administration, the *Strategy* aligns multiple planning efforts at all levels of government, provides a framework for applying science-based information and tools to inform management decisions in the face of uncertainty, identifies partnership opportunities, and will help target resources to highest priority needs. It is not a regulatory document, but rather concisely describes the impacts climate change is having on our ecosystems and natural resources, and recommends climate adaptation goals, strategies, and actions that should be taken or initiated in the next five to ten years in light of the best scientific information available.

The Fish and Wildlife Service took a leadership role in developing the *Strategy* from the beginning. On behalf of the Department of the Interior, the Service co-led the effort with the National Oceanic and Atmospheric Administration and the New York State Department of Environmental Conservation (representing state fish and wildlife agencies more broadly). The final *Strategy* reflects revisions based on public comments and scientific peer review of an earlier draft.

The *Strategy* is also a cornerstone of our agency's own response to climate change. Preparation and implementation of the NFWPCAS with partners was "Adaptation Goal 1" in the U.S. Fish and Wildlife Service's 2010 Strategic Plan for Climate Change,[3] and the *Strategy* reiterates many of the Strategic Plan's recommendations such as incorporating climate change into activities and decisions, promoting habitat connectivity, and supporting coordinated monitoring efforts. It is also in sync with our efforts to implement Strategic Habitat Conservation as a framework for conserving species populations at landscape scales. In addition, the recently finalized Service Policy on Climate Change Adaptation (056 FW 1) states that it is Service policy to work with partners to implement the *Strategy*. Finally, this effort was also called out in the President's Climate Action Plan released this summer, which lays out steps to cut carbon pollution that is a primary cause of climate change.

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[1] http://www.doi.gov/news/pressreleases/national-strategy-will-help-safeguard-fish-wildlife-and-plants-in-a-changing-climate.cfm

[2] For highlights see: http://www.wildlifeadaptationstrategy.gov/pdf/Strategy-Highlights-Brochure.pdf
For a 2-page summary, see: http://www.wildlifeadaptationstrategy.gov/pdf/New_Strategy_Factsheet.pdf

[3] USFWS 2010: http://www.fws.gov/home/climatechange/strategy.html

I. Suggestions for Using the *Strategy*

The *Strategy* is organized into five core chapters (see Table 1) and several supplementary sections. The first chapter explains the origins, vision, guiding principles, and development of this effort, describing the need for action and explaining how to use this document. The second chapter outlines major current and projected impacts of climate change on the eight major ecosystem types of the United States and on the fish, wildlife, and plant species that are part of those ecosystems. The heart of the NFWPCAS is the third chapter, which lays out the goals, strategies, and actions that can help fish, wildlife, plants, and ecosystems be more resilient and adapt to a changing climate. Each goal also has a short-term progress check list of items intended to serve as milestones of progress toward achieving the goal. The fourth chapter highlights some of the important roles and opportunities for sectors such as agriculture, energy, and transportation in identifying adaptation co-benefits and promoting climate adaptation of fish, wildlife, and plants through their activities. The final chapter discusses implementation and integration, outlining how stakeholders at all levels of government can use this *Strategy* as a resource.

The National Fish, Wildlife and Plants Climate Adaptation Strategy	
Front Material	Preface & Executive Summary
Chapter 1	About the *Strategy*
Chapter 2	Impacts of Climate Change & Ocean Acidification
Chapter 3	Climate Adaptation Goals, Strategies, and Actions
Chapter 4	Opportunities for Multiple Sectors
Chapter 5	Integration & Implementation
Resources	Literature cited, glossary, and other supporting materials

Relationship to Existing Management Programs (*Strategy*, p. 53)

This *Strategy* seeks to assist the management community to better understand the application of tools that may be most effective in a period of climate change. In other words, this *Strategy* seeks to integrate with and build upon existing management programs. *Strategy* goals are intended to be implemented with full recognition of the existing authorities of those who implement and will be affected by the activities. These goals represent tools within the conservation toolbox.

Benefits of using the *Strategy* to help guide the Service's work include:

- Building awareness and understanding across agency staff of climate change and its impacts on natural systems, climate adaptation concepts, ongoing activities and examples, and resources for more information;
- Increasing efficiency – with limited fiscal resources and urgent conservation needs, it is more important than ever to share information that can save time and avoid duplication of effort, and to leverage capacity by working with others;
- Supporting increased collaboration with other sectors (e.g. energy, transportation, agriculture, water resources) to identify "win-win" climate adaptation measures, avoid

maladaptative actions, and ensure that the needs and vulnerabilities of natural systems are appropriately considered in broader adaptation planning;

- Helping guide and improve our continuing efforts to engage in strategic habitat conservation, i.e., doing the right things in the right places;
- Supporting and validating the Service's current and planned work to address climate change, and raising the profile of this issue across the agency;
- Helping prepare the Service for important conversations around the need for development or modification of policies, guidelines, criteria, training materials, decision support tools, and other mechanisms that support and guide on-the-ground actions.

Implementing the *Strategy* within the Service

Although Service Regions and Programs will find opportunities to utilize and implement the *Strategy* in different ways, here are three steps for we can all take to begin implementation:

1. All Service employees are encouraged to become familiar with the recommendations and approaches in this document. The Synopsis (Section II below) highlights key concepts and sections to aid in this process.

2. Examine how ongoing and planned Service activities are aligned with the *Strategy* framework. As noted in the *Strategy* and illustrated by the Examples section below, many ongoing and new activities are consistent with the Strategy's recommendations and contribute to its implementation. Others, however, may need to be revisited.

3. Look for opportunities to incorporate appropriate elements of the *Strategy* into plans and actions at national to local levels.

Ultimately, successful implementation of the *Strategy* will entail developing specific objectives, selecting and implementing actions, and evaluating, learning, and adjusting as needed.

As the *Strategy* is national in scope, its goals, strategies, actions, and check list items vary in applicability to different users, locations, and circumstances. Many of the actions are familiar, while others are new or rarely used currently. Some are relevant to on-the-ground work or analyses conducted on a day-to-day basis at field offices. For example, *Action 4.2.3: Conduct vulnerability and risk assessments for habitat and priority species* may be implemented by Ecological Services staff in various field offices which have the lead for a particular species and its habitat, in coordination with appropriate partners. Other actions relate to work at Regional Offices or Headquarters, such as the development of policies, guidelines, or decision support tools, while others should be handled via collaboration among multiple agencies and other partners. For example, *Action 4.2.4: Define national standards and criteria to identify fish, wildlife, plants, and ecosystems most vulnerable to climate change impacts* is not a task that will be done at individual field offices, let alone solely by the Service.

Examples of Service activities aligned with *Strategy* recommendations

The *Strategy* highlights many natural resources conservation activities that the Service has traditionally undertaken which are still critical in a period of climate change, such as conserving habitat, restoring degraded systems, monitoring populations, and engaging the public. It also describes areas where these and other traditional approaches may need to be modified or reconsidered in order to respond to new challenges and changing conditions, such as incorporating climate change into new and future revisions of species, habitat, and area management plans, revising priorities for habitat restoration, adjusting monitoring approaches, developing new training and tools, and prioritizing scientific research on vulnerable systems.

Goal 1: Conserve habitat to support healthy fish, wildlife, and plant populations and ecosystem functions in a changing climate.

- ✓ **Strategy 1.1, Action 1.1.1: Identify and map high priority areas for conservation**. The California LCC has provided support for the Upland Habitat Goals project, a science-based process using existing data supplemented by expert opinion to identify a Conservation Lands Network for biodiversity preservation to inform conservation investments. The final report includes recommendations for types, amounts and distribution of habitats, linkages, compatible uses and the ecological processes needed to sustain diverse and healthy ecosystems in upland habitats beyond the baylands.
- ✓ **Strategy 1.1, Action 1.1.2: Identify and prioritize areas currently experiencing rapid climate impacts**. The Alaska and Canada Climate-Biome Shift Projects used existing land cover designations and climate data to identify areas of Alaska, the Yukon, and Northwest Territories that are likely to undergo ecological pressure given climate change. The projects modeled future projected shifts in climate-biomes (or "cliomes") to help guide stakeholders in the management of areas of greatest and lowest resilience. These projects were made possible by the Service and a variety of NGO, academic, and local partners.
- ✓ **Strategy 1.1, Action 1.1.4: Establish and maintain an inventory of conservation areas to coordinate future conservation efforts.** The South Atlantic LCC is working on a regional conservation blueprint for the South Atlantic region to sustain natural and cultural resources by working across jurisdictional boundaries, focusing on protection, maintenance and restoration of healthy ecosystems, and building resilience into ecological systems. They are also coordinating with the other LCCs in the southeast to ensure this blueprint scales to a larger ecologically connected network.

Goal 2: Manage species and habitats to protect ecosystem functions and provide sustainable cultural, subsistence, recreational, and commercial use in a changing climate.

- ✓ **Strategy 2.1, Action 2.1.1: Incorporate climate change considerations into species and area management plans.** The Wildlife and Sport Fish Restoration Program has developed a special subprogram for states seeking to incorporate climate change science into the State Wildlife Action Plans. For example, Colorado Parks and Wildlife will utilize State Wildlife Grant funds to collect and analyze a variety of datasets including climate projections and species distribution models, to produce a vulnerability assessment for at least 10 major habitats and their associated species.

- ✓ **Strategy 2.1, Action 2.1.3: Identify species and habitats particularly vulnerable to transition under climate change.** In an effort to focus on its greatest conservation needs, Region 7 implemented a careful species prioritization process to identify species considered most in need of conservation action due to current or anticipated declines, their ecological importance, or their high value as a harvested species. Species Conservation Frameworks will be developed for 35 "Tier 1" species considered to be in most need of conservation focus to serve as the foundation for conservation design, delivery and evaluation.
- ✓ **Strategy 2.2, Action 2.2.1: Use vulnerability and risk assessments to design and implement management actions.** State Wildlife Grant Program funds will be used to help resource managers anticipate and address impacts of climate change. The Colorado Department of Parks and Wildlife will design a landscape-scale reptile monitoring program that assesses essential habitats and evaluates climate-related risk factors. The Maine Department of Inland Fisheries and Wildlife will incorporate vulnerability science into their State Wildlife Action Plan, providing better guidance to agencies and partners at appropriate scales.
- ✓ **Strategy 2.2, Action 2.2.2: Develop criteria and guidelines for translocation, assisted relocation, and captive breeding as climate adaptation strategies.** The Service's Headquarters office has representatives on an interagency working group that is examining the existing legal and policy framework for species translocations, including assisted relocation. This initial step of gathering and evaluating information is intended to provide the basis for revising existing or developing new criteria and guidelines for species translocations, including managed relocation, as a climate adaptation tool.
- ✓ **Strategy 2.2, Action 2.2.3: Actively manage populations of vulnerable species.** Using information on sea level rise and tidal surge, the FWS Florida Ecological Service's Office (Region 4) recently worked with partners to establish an endangered species, the Key tree cactus, in a higher elevation area in the Florida Keys. This is an interim measure specifically designed to "buy time" for the species in the face of rising seas.

Goal 3: Enhance capacity for effective management in a changing climate.

- ✓ **Strategy 3.1, Action 3.1.2: Build on existing training courses, develop curricula.** The Pacific Region (R1) conceived the Climate Savvy Restoration Class that was held for restoration biologists and managers both in person and through WebEx. The class covered climate trends and projections, biological response to climate change, hydrologic response and models, and restoration techniques that specifically address climate threats.
- ✓ **Strategy 3.1, Action 3.1.3: Develop training on the use of tools for managing under uncertainty.** Working with partners, NCTC recently developed and held a pilot training course on climate change scenario planning, coordinated with development (under contract to FWS) of a guide to climate change scenario planning.
- ✓ **Strategy 3.1, Action 3.1.8: Develop training materials to help managers and decisionmakers apply climate knowledge.** The National Wildlife Refuge system is working to ensure that climate change training is provided to current Refuge System staff, as well as producing targeted climate change educational materials for different audiences that can be adapted for local refuges. These include climate change tool kits, virtual scavenger hunts and field trips, and other materials that can be easily adapted for use by field stations.

- ✓ **Strategy 3.2, Action 3.2.2: Identify and address conflicting management objectives.** The Alaska Climate Change Executive Roundtable, established jointly by the Service and the U.S. Geological Survey in 2007, is comprised of both federal and non-federal senior level agency executives who meet regularly to share information and facilitate cooperation among agencies in seeking solutions to the challenges presented by climate change. The Roundtable promotes collaboration, helps leverage member resources to meet priority needs, and provides overall strategic guidance for the interagency partners.
- ✓ **Strategy 3.2, Action 3.2.3: Integrate individual agency and state climate change adaptation programs.** The Wildlife and Sport Fish Restoration Program has sought to incentivize collaborative State, University, and NGO conservation initiatives through the Competitive State Wildlife Grants (SWG) Program. New program requirements and criteria prioritize projects featuring multi-state, regional approaches to species conservation which incorporate climate science. Many competitive SWG projects involve partnerships of multiple states, LCCs, Universities, and other key conservation partners.

Goal 4: Support adaptive management in a changing climate through integrated observation and monitoring and use of decision support tools.

- ✓ **Strategy 4.1, Action 4.1.3: Support integrated national observation and information systems that inform climate adaptation.** A Region 1 project will use the information and recommendations from water resources inventory and assessments and from other sources to fill data gaps and improve the accuracy of future water related climate change predictions for NWRs and NFHs. Identifying specific thermal or hydrological measurements useful for monitoring or predicting future conditions is a key consideration. Information such as water temperature and water flow data collected over time are necessary for monitoring water-related climate change impacts on NWRs and NFHs.
- ✓ **Strategy 4.1, Action 4.1.5: Develop consensus standards and protocols that enable interoperability of databases.** The interagency Alaska Data Integration Working Group (ADIwg) was formed to examine and address the technical barriers to efficiently integrate and share data among participating organizations. In order to facilitate data discovery and sharing across agencies, ADIwg developed an interagency standard and protocol for the exchange of project metadata. Region 7 is an active participant of ADIwg and has adopted the project metadata standards as part of the Refuges Program survey-of-surveys (PRIMR).
- ✓ **Strategy 4.2, Action 4.2.3: Conduct vulnerability and risk assessments.** Region 2 is working to support various climate change vulnerability assessments, including with the Desert and Southern Rockies LCCs and other partners to conduct a High Elevation Native Pollinator Survey to examine climate change effects to vegetation and associated pollinating insects.
- ✓ **Strategy 4.2, Action 4.2.5: Synthesize vulnerability assessments across jurisdictions.** Region 1 is funding, leading, or supporting a variety of vulnerability assessments to identify which species, systems or management objectives are likely to be most strongly affected by projected changes and why these resources are likely to be vulnerable. Completed or ongoing projects include assessments around the Snake River Plain, Sheldon/Hart NWRC, Winthrop NFH and other hatcheries, Coquille Estuary, and the Pacific Islands, as well as for bull trout, pacific lamprey, and other species and habitats.

- ✓ **Strategy 4.2, 4.2.7: Ensure the availability of and provide guidance for decision support tools.** In the southeast, the Southeast Aquatic Resources Partnership (SARP) is developing an online tool to help conservation practitioners identify the best places to target on-the-ground conservation actions based on flexible user-selected criteria. The tool will include a prioritization model that will quantitatively integrate information from state and federal agencies, NGOs, and other partners with water quality, landcover, soils, and other data to inform selection of aquatic habitat preservation, enhancement, and restoration projects.

Goal 5: Increase knowledge and information on impacts and responses of fish, wildlife, and plants to a changing climate.

- ✓ **Strategy 5.2, Various Actions: Conduct Research into Climate Change**. In addition to many examples of Service research taking place at multiple locations and scales, Landscape Conservation Cooperatives across the country are in various stages of identifying, prioritizing and communications science needs to CSCs and other research institutions. For example, the North Atlantic LCC is working with partners to identify priority needs and support applied research activities that test key assumptions and inform future planning and delivery, provide guidance to Climate Science Centers on LCC needs, and work with partners to coordinate ongoing research initiatives on priority conservation issues.

Goal 6: Increase awareness and motivate action to safeguard fish, wildlife, and plants in a changing climate.

- ✓ **Strategy 6.2, Various Actions: Engage the public through targeted education and outreach efforts and stewardship opportunities.** The Service works to share information and engage the public through many outreach and visitor services activities. For example, the National Wildlife Refuge System is working to cultivate a front line of Refuge System staff, Friends groups, and long-term volunteers to serve as "Climate Change Ambassadors" to engage and inspire Refuge visitors, local communities and school systems, and other Service staff to take personal and collective mitigation and adaptation actions. This effort is part of implementing the Refuge System Vision *Conserving the Future*.

Goal 7: Reduce non-climate stressors to help fish, wildlife, plants, and ecosystems adapt to a changing climate.

- ✓ **Strategy 7.2, Various Actions: Slow, mitigate and reverse habitat degradation.** Reducing non-climate stressors on fish and wildlife has long been a primary focus of Service programs, and is also important for increasing resilience in a changing climate. For example, in the Gulf of Mexico, natural disasters like hurricanes and manmade disasters like oil spills have combined with habitat fragmentation and other stressors to make the system more vulnerable to climate change and sea level rise. In the wake of the 2010 Deepwater Horizon oil spill, the Service is working with state, tribal and other federal partners through the Natural Resource Damage Assessment process to recover damages from those responsible, and plan and carry out restoration which will include anticipating the effects of climate change on long-term restoration projects. In addition, the Service is working to build resilience in the Gulf by using Wildlife Refuges to connect existing conservation lands, buffer areas and corridors to make provide species the ability to move across the landscape.

II. Synopsis – A Quick Summary of the Strategy

The material that follows is a synopsis of key points in the National Fish, Wildlife and Plants Climate Adaptation Strategy. Much of the text is quoted verbatim from the *Strategy*, and the relevant pages that are sources of the material are cited for ease of reference.

This quick summary begins with a description of the conceptual framework of climate change adaptation in the context of natural resources. This topic is foundational for the entire NFWPCAS, and thus is an important starting point for becoming familiar with and implementing the *Strategy*.

Adaptation to Climate Change (*Strategy*, pp. 14-15)

As discussed early in the NFWPCAS (see *Strategy*, pp. 9-14), addressing the root causes of climate change will require reducing the levels of greenhouse gases (GHGs) in the Earth's atmosphere. Actions to reduce emissions that lead to climate change are known as mitigation. However, it is clear from current trends and future projections that we are now committed to a certain amount of climatic changes and impacts. Coordinated planning can help limit the damage caused by climate change to our natural resources and communities. Actions to prepare for and address climatic changes to reduce negative impacts and take advantage of potential benefits from a changing climate are known as adaptation.

Within the field of climate change, the scientific community defines adaptation as an "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities" (IPCC WGII 2007). Of course, this differs from the classic definition of adaptation in evolutionary biology. Human intervention will not be able to make species adapt to climate change, though our actions can make such adaptation more or less likely. The ability of populations, species, or systems to adapt to a changing climate is often referred to as their adaptive capacity.

For the Service, climate adaptation is "planned, science-based management actions, including regulatory and policy changes, that we take to reduce the negative impacts of climate change on fish, wildlife, and their habitats."[4] Adaptation forms the core of our agency's response to climate change, and may include a variety of actions along the resistance-resilience-transformation continuum.

The *Strategy* describes three general types of adaptation responses along a commonly used continuum of possible responses to climate change:

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[4] U.S. Fish and Wildlife Service (FWS). 2011. Rising to the Urgent Challenge: Strategic Plan for Responding to Accelerating Climate Change. http://www.fws.gov/home/climatechange/strategy.html

Ability of a system to remain essentially intact or unchanged

Ability of a system to recover from a disturbance, returning to its original state

Change in a system's composition and/or function due to climate change or other factors

The terms "resistance," "resilience" and "transformation" are used differently in various contexts. In the Strategy, they describe broad categories of responses to different levels of change. At one end of the continuum is resistance, referring to persistence in spite of change, e.g., a species might not be sensitive to changes in climate and related conditions, or has the capacity to withstand such changes. For example, a fish population may not respond strongly to rising air temperatures due to the buffering influence of groundwater or snowmelt on stream temperatures, or because conditions remain within the range of thermal tolerances.[5] At the other end is transformation, e.g. a change in the species composition in an area, or a change in a system (e.g. forest to shrubland, cool water to warm water, etc.).

In general ecological usage, resilience typically refers to the capacity of a system to return to its original state following a perturbation, including maintaining its essential characteristics of taxonomic composition, structure, ecosystem functions, and processes. For a species, an example could be a reduction in abundance, followed eventually by a rebound in numbers. In the emerging context of climate change, however, return to an original state is unlikely for many systems or species, so in this context resilience is commonly thought of as the ability to recover from or adjust relatively easily, over time, to change.

Conducting a climate-focused sensitivity analysis and/or vulnerability analysis for species and/or habitats should be undertaken to determine appropriate "adaptation" actions. These should carefully consider whether the desired outcome in any given situation should be to try to increase the resistance of a natural system to climate change, to attempt to make it more resilient to change, or to facilitate its transformation into a new and different state – or to achieve some combination of all three outcomes over appropriate spatial and temporal scales.[6]

While managing for change and transformation may be increasingly necessary over time, promoting resistance or resilience will continue to be valuable in many situations, especially in the near term. The *Strategy* includes recommendations that cover all three types of adaptation responses: resistance (e.g., managed wetlands on Refuges, protecting certain less-climate

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[5] See:

[6] Also see: Peterson, D.L., C.L. Millar, L.A. Joyce, M.J. Furniss, J.E. Halofsky, R.P. Neilson, and T.L. Morelli. 2011. *Responding to climate change in national forests: a guidebook for developing adaptation options*. Gen. Tech. Rep. PNW-GTR-855. Portland, OR. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 109p. http://www.fs.fed.us/pnw/pubs/pnw_gtr855.pdf

sensitive habitats, controlling invasive species and/or maintaining natural disturbance regimes in these habitats, etc.); resilience (e.g., managing for genetic diversity, restoring degraded habitat, etc.); and transformation (e.g., establishing corridors to enable range shifting, considering managed relocation, shifting from management for cold-water species to warm-water species, etc.). There is no "one-size-fits-all" approach and changes in approach may be appropriate over time. For example, initially actions might be aimed at supporting resistance or resilience, to increase the likelihood of sufficient time for genetic or phenotypic changes (adaptive capacity), or the likelihood that range shifts will be successful and populations will persist in other locations.

Because climate change is a long-term problem, the timing of adaptation decisions is important to consider. For example, early action may be more cost effective in situations where long-lived infrastructure investments are being considered. In these cases, it is likely to be less costly to make adjustments early, in the design phase of the project, rather than incur the cost and inconvenience of expensive retrofits. Early adaptation actions will also be justified if they have immediate benefits, for example, by reducing the effects of climate variability. In addition, adaptation actions that have ancillary benefits such as measures to preserve and strengthen the relative resilience of natural ecosystems also may be justified in the short-term.

Strategy **Purpose, Vision, Guiding Principles** (*Strategy*, p. 17)

Purpose

Inspire and enable natural resource professionals and other decision makers to take action to conserve the nation's fish, wildlife, plants, and ecosystem functions, as well as the human uses and values these natural systems provide, in a changing climate.

Vision

Ecological systems will sustain healthy, diverse, and abundant populations of fish, wildlife, and plants. These systems will provide valuable cultural, economic, and environmental benefits in a world impacted by global climate change.

Guiding Principles

- Build a national framework for cooperative response.
- Foster communication and collaboration across government and non-government entities.
- Engage the public.
- Adopt a landscape /seascape based approach that integrates best available science and adaptive management.
- Integrate strategies for natural resources adaptation with those of other sectors.
- Act now. Immediate planning and action are needed.

Goals and Strategies (*Strategy*, pp. 53 – 78)

The *Strategy* identifies seven goals (pp. 53-54) to help fish, wildlife, plants, and ecosystems cope with the impacts of climate change (see Table 1). These overarching goals were developed collectively by diverse teams of federal, state, and tribal scientists and managers, based on existing research and understanding regarding the needs of fish, wildlife, and plants in the face of climate change. Each goal identifies a set of initial strategies and actions that should be taken or initiated over the next five to ten years. The goals and strategies for each are shown in Table 2. (See Appendix 1 of this document for a complete list of strategies, action items, and progress check lists for each goal.)

Table 1: Goals-at-a-Glance (*Strategy,* p. 54)

Goal Statement	Description
Goal 1. Conserve habitat to support healthy fish, wildlife, and plant populations and ecosystem functions in a changing climate.	Sustaining a diversity of healthy populations over time requires conserving a sufficient variety and amount of habitat and building a well-connected network of conservation areas to allow the movement of species in response to climate change.
Goal 2. Manage species and habitats to protect ecosystem functions and provide sustainable cultural, subsistence, recreational, and commercial use in a changing climate.	Incorporating climate change information into fish, wildlife, and plant planning and management efforts is essential to safeguarding these valuable natural resources.
Goal 3: Enhance capacity for effective management in a changing climate.	Climate change adaptation requires new ways of assessing information, new management tools and professional skills, increased collaboration across jurisdictions, and a review of laws, regulations, and policies.
Goal 4: Support adaptive management in a changing climate through integrated observation and monitoring and use of decision support tools.	Coordinated observation, information management, and decision support systems can help management strategies to be adaptive and adjust to changing conditions.
Goal 5: Increase knowledge and information on impacts and responses of fish, wildlife, and plants to a changing climate.	Research must be targeted to address key knowledge gaps and needs, and findings must be rapidly incorporated into decision support tools available to natural resource managers and other decision makers.
Goal 6: Increase awareness and motivate action to safeguard fish, wildlife, and plants in a changing climate.	Climate change adaptation efforts will be most successful if they have broad popular support and if key groups and people (such as private landowners) are motivated to take action.
Goal 7: Reduce non-climate stressors to help fish, wildlife, plants, and ecosystems adapt to a changing climate.	Reducing existing threats such as habitat degradation and fragmentation, invasive species, pollution, and over-use can help fish, wildlife, plants, and ecosystems better cope with the additional stresses caused by a changing climate.

Table 2: Goals & Strategies (*Strategy*, pp. 55-78) (Appendix 1 of this document shows goals, strategies, actions and progress check lists)

Goal	Strategies
Goal 1: Conserve habitat to support healthy fish, wildlife, and plant populations and ecosystem functions in a changing climate.	**Strategy 1.1**: Identify areas for an ecologically-connected network of terrestrial, freshwater, coastal, and marine conservation areas that are likely to be resilient to climate change and to support a broad range of fish, wildlife, and plants under changed conditions. **[*5 actions*]** **Strategy 1.2**: Secure appropriate conservation status on areas identified in Action 1.1.1 to complete an ecologically connected network of public and private conservation areas that will be resilient to climate change and support a broad range of species under changed conditions. **[*5 actions*]** **Strategy 1.3**: Restore habitat features where necessary and practicable to maintain ecosystem function and resiliency to climate change. **[*6 actions*]** **Strategy 1.4**: Conserve, restore, and as appropriate and practicable, establish new ecological connections among conservation areas to facilitate fish, wildlife, and plant migration, range shifts, and other transitions caused by climate change. **[*6 actions*]**
Goal 2: Manage species and habitats to protect ecosystem functions and provide sustainable cultural, subsistence, recreational, and commercial use in a changing climate.	**Strategy 2.1**: Update current or develop new species, habitat, and land and water management plans, programs and practices to consider climate change and support adaptation. **[9 *actions*]** **Strategy 2.2**: Develop and apply species-specific management approaches to address critical climate change impacts where necessary. **[*3 actions*]** **Strategy 2.3**: Conserve genetic diversity by protecting diverse populations and genetic material across the full range of species occurrences. **[*5 actions*]**
Goal 3: Enhance capacity for effective management in a changing climate.	**Strategy 3.1**: Increase the climate change awareness and capacity of natural resource managers and other decision makers and enhance their professional abilities to design, implement, and evaluate fish, wildlife, and plant adaptation programs. **[7 *actions*]** **Strategy 3.2**: Facilitate a coordinated response to climate change at landscape, regional, national, and international scales across state, federal, and tribal natural resource agencies and private conservation organizations. **[*6 actions*]** **Strategy 3.3**: Review existing federal, state and tribal legal, regulatory and policy frameworks that provide the jurisdictional framework for conservation of fish, wildlife, and plants to identify opportunities to improve, where appropriate, their usefulness to address climate change impacts. **[*7 actions*]** **Strategy 3.4**: Optimize use of existing fish, wildlife, and plant conservation funding sources to design, deliver, and evaluate climate adaptation programs. **[*6 actions*]**

Goal	Strategies
Goal 4: Support adaptive management in a changing climate through integrated observation and monitoring and use of decision support tools.	**Strategy 4.1**: Support, coordinate, and where necessary develop distributed but integrated inventory, monitoring, observation, and information systems at multiple scales to detect and describe climate impacts on fish, wildlife, plants, and ecosystems. **[*9 actions*]** **Strategy 4.2**: Identify, develop, and employ decision support tools for managing under uncertainty (e.g., vulnerability and risk assessments, scenario planning, strategic habitat conservation approaches, forecasting, and adaptive management evaluation systems) via dialogue with scientists, managers (of natural resources and other sectors), economists, and stakeholders. **[*8 actions*]**
Goal 5: Increase knowledge and information on impacts and responses of fish, wildlife, and plants to a changing climate.	**Strategy 5.1**: Identify knowledge gaps and define research priorities via a collaborative process among federal, state, tribal, private conservation organization, and academic resource managers and research scientists. **[*6 actions*]** **Strategy 5.2**: Conduct research into ecological aspects of climate change, including likely impacts and the adaptive capacity of species, communities and ecosystems, and their associated ecosystem services, working through existing partnerships or new collaborations as needed (e.g., USGCRP, NCA, CSCs, RISAs, and others). **[*5 actions*]** **Strategy 5.3**: Advance understanding of climate change impacts and species and ecosystem responses through modeling. **[*3 actions*]**
Goal 6: Increase awareness and motivate action to safeguard fish, wildlife, and plants in a changing climate.	**Strategy 6.1**: Increase public awareness and understanding of climate impacts to natural resources and ecosystem services and the principles of climate adaptation at regionally and culturally-appropriate scales. **[*4 actions*]** **Strategy 6.2**: Engage the public through targeted education and outreach efforts and stewardship opportunities. **[*6 actions*]** **Strategy 6.3**: Coordinate climate change communication efforts across jurisdictions. **[*3 actions*]**
Goal 7: Reduce non-climate stressors to help fish, wildlife, plants, and ecosystems adapt to a changing climate.	**Strategy 7.1:** Slow and reverse habitat loss and fragmentation. **[*8 actions*]** **Strategy 7.2:** Slow, mitigate, and reverse where feasible ecosystem degradation from anthropogenic sources through land/ocean- use planning, water resource planning, pollution abatement, and the implementation of best management practices. **[*8 actions*]** **Strategy 7.3:** Use, evaluate, and as necessary, improve existing programs to prevent, control, and eradicate invasive species and manage pathogens. **[*7 actions*]** **Strategy 7.4:** Reduce destructive capture practices (e.g., fisheries bycatch, destructive fishing gear), over-harvesting and illegal trade to help increase fish, wildlife, and plant adaptation. **[*3 actions*]**

Progress Check Lists (*Strategy*, pp. 53-78)

One of the useful features of the NFWPCAS is that in addition to providing goals and related strategies and actions for achieving them, the *Strategy* also has a "Progress Check List" for each goal. Table 3 provides an example. The items in the check list can be thought of as providing milestones for implementation of the Strategy. Each of the items in these lists could be achieved or initiated over the next five to ten years by pursuing the strategies and actions under each goal (see Appendix 1 in this document). Accomplishing these items will show real progress in implementing the *Strategy* and help to recognize that work on all of these goals is already underway. Although the progress check list items are not a one-to-one match for every action associated with an individual goal, they provide milestones and point to key outcomes expected over time.

Table 3: Progress Check List for Goal 1 (Appendix 1 of this document has check lists for each goal)

Goal	Progress Check List
Goal 1 ***Conserve habitat to support healthy fish, wildlife, and plant populations and ecosystem functions in a changing climate.***	**GOAL 1 - PROGRESS CHECK LIST** ☐ Areas resilient to climate change identified; ☐ Gap analysis of geophysical settings completed and priority candidate areas identified; ☐ Desired ecological connectivity among conservation areas identified; ☐ Baseline comprehensive inventory of conservation areas completed; ☐ Suite of land protection tools (designations, exchanges, acquisitions, easements, leases, incentives) evaluated and updated; ☐ Protocols for incorporating climate change into ecological restoration efforts developed and implemented; ☐ Begin conserving and/or restoring high priority areas for fish, wildlife, and plants under climate change.

Opportunities for Multiple Sectors (*Strategy*, pp. 79-87)

The NFWPAS describes five "sectors" that are recognized as having impacts on species, yet also present opportunities for coordinated adaptation strategies to provide co-benefits that have positive outcomes for both natural systems and the sector. These sectors include agriculture, energy, housing and urbanization, transportation and infrastructure, and water resources. The *Strategy* briefly describes ongoing and projected impacts of climate change, a case study, and climate adaptation strategies for each sector which also benefit natural resources. In addition, the *Strategy* defines several climate adaptation strategies common to all sectors, including:

1. Improve the consideration of impacts to fish, wildlife, and plants in the development of sector-specific climate adaptation strategies.

2. Enhance coordination between sectors and natural resource managers, land-use planners, and decision makers regarding climate change adaptation.

3. Use integrated planning to engage all levels of government (local, state, federal, and tribal) and multiple stakeholders in multi-sector planning.

4. Make best available science on the impacts of climate change on fish, wildlife, and plants accessible and useable for planning and decision-making across all sectors.

5. Explicitly consider natural resource adaptation in sector-specific climate adaptation planning.

6. Improve, develop, and deploy decision support tools, technologies, and best management practices that incorporate climate change information to reduce impacts on fish, wildlife, and plants.

7. Assess the need for, and the utility of, expanding compensatory mitigation requirements for projects that reduce ecosystem resilience.

In addition to these overarching climate adaptation strategies common to all sectors, the NFWPCAS identifies other strategies that are particularly suitable for each of the five sectors that can and can benefit fish, wildlife and plants. See Appendix 2 for the strategies for each sector.

Integration and Implementation (*Strategy*, pp. 88-92)

The *Strategy* concludes with a discussion of how it builds on and complements many existing climate adaptation efforts, and notes that continuation and expansion of those efforts will be essential for achieving the goals of the *Strategy*. Although the *Strategy* identifies some of the essential actions that can be taken or initiated in the next five to ten years, its success relies on additional planning and action by federal, tribal, state, and local governments and many partners.

To ensure effective coordination, implementation, tracking, and updating of the *Strategy*, several key steps are identified for implementation.[7] First, the *Strategy* recommends that Federal, state, and tribal governments and conservation partners incorporate appropriate elements of the *Strategy* (goals, strategies, and actions) into their plans and actions at national to local levels (for example, development of implementation plans by federal, state, and tribal governments). The goal is for partners at multiple levels to step down the *Strategy* by pulling in the most relevant and appropriate activities into their planning efforts.

[7] See the *Strategy* for the complete list of proposals.

To help promote implementation moving forward, the *Strategy* also proposes the formation of an inter-jurisdictional coordinating group with policy maker representation and staff support from federal, state, and tribal governments. The Service is currently working with partners to develop a Joint Implementation Working Group that will help support interagency coordination. This body will be tasked with promoting awareness, understanding, and use of the *Strategy* as a key tool in addressing climate change, as well as engage non-governmental organizations, private landowners, and other stakeholders, identify and highlight examples of successful *Strategy* implementation, as well as guide future revisions of the *Strategy*.[8] The *Strategy* also identifies key roles for the Landscape Conservation Cooperatives (LCCs) to help facilitate transition from the framework of this *Strategy* to geographically specific implementation action plans. LCCs are being encouraged to identify appropriate activities and to step down Strategy recommendations into actions and regional plans.

In addition to the *Strategy*, the Service recently adopted its first climate change adaptation policy (056 FW 1) which calls for the Service to work with partners to implement both the Service's own Climate Change Strategic Plan and the Strategy. Moving forward, as part of a Department of the Interior initiative the Service will form a Climate Adaptation Network in FY 2014. The Network will work to identify and address the need for further guidance on implementing the *Strategy* for particular Service programs, activities or topic areas, supplementing our leadership and support of collaborative interagency adaptation through the Landscape Conservation Cooperative Network. Additional climate change policies regarding adaptation, mitigation, and engagement will be developed over the next few years to help guide efforts by all levels of the Service to integrate climate change information into our analyses, decisions, and actions to conserve trust resources.

Conclusion

The Service will continue to play a leadership role in this effort as we move into the implementation phase of the Strategy. We are committed to co-leading the Joint Implementation Working Group described above. The Office of the Science Advisor will continue to work with the National Climate Team to reach out to Service Programs and Regions to help identify current and future FWS activities that support the *Strategy* recommendations, to ensure that our agency is doing its part to turn this *Strategy* into adaptation on the ground. Ultimately, however, the key to successful implementation will be Service staff becoming familiar with the *Strategy* and utilizing the framework it provides, and to engage in recommended activities that will help us meet the many challenges posed by a changing climate.

[8] NOTE: Although a formal decision has not been made, the timeline for the revision process is expected to change from what is described in the *Strategy*.

III. Appendix: Goals, Strategies, and Actions

Appendix I: Goals, Strategies & Actions	
Strategy	**Action**
Goal 1: Conserve habitat to support healthy fish, wildlife, and plant populations and ecosystem functions in a changing climate.	
Strategy 1.1: Identify areas for an ecologically-connected network of terrestrial, freshwater, coastal, and marine conservation areas that are likely to be resilient to climate change and to support a broad range of fish, wildlife, and plants under changed conditions.	1.1.1: Identify and map high priority areas for conservation using information such as species distributions (current and projected), habitat classification, land cover, and geophysical settings (including areas of rapid change and slow change).
	1.1.2: Identify and prioritize areas currently experiencing rapid climate impacts (e.g., the coastline of Alaska, low-lying islands, and high alpine tundra).
	1.1.3: Assess the potential of species to shift ranges, and prioritize conservation efforts taking into account range shifts and accounting for ecosystem functions and existing and future physical barriers.
	1.1.4: Establish and maintain a comprehensive, inter-jurisdictional inventory of current conservation areas and candidate high priority conservation areas in order to coordinate future conservation efforts.
	1.1.5: Re-prioritize conservation targets of existing land and water conservation programs in light of areas identified in 1.1.1.and listed in 1.1.4 and 1.4.2.
Strategy 1.2: Secure appropriate conservation status on areas identified in Action 1.1.1 to complete an ecologically connected network of public and private conservation areas that will be resilient to climate change and support a broad range of species under changed conditions.	1.2.1: Conserve areas identified in Action 1.1.1 that provide high priority habitats under current climate conditions and are likely to be resilient to climate change and/or support a broad array of species in the future.
	1.2.2: Conserve areas representing the range of geophysical settings, including various bedrock geology, soils, topography, and projected climate, in order to maximize future biodiversity.
	1.2.3: Build back-up redundancy into the network of conservation areas by protecting multiple examples of the range of priority areas identified in Action 1.1.1.
	1.2.4: Work with partners at landscape scales to strengthen and maximize use of existing conservation programs, particularly the conservation title of the Farm Bill, conservation easement tax incentives, the private lands programs focused on endangered species, and other federal and state private lands incentive programs to conserve private lands of high conservation value, to enhance habitat values and maintain working landscapes under climate change.
	1.2.5: Identify and pursue opportunities to increase conservation of priority lands and waters by working with managers of existing public lands such as military installations or state lands managed for purposes other than conservation.
Strategy 1.3: Restore habitat features where necessary and practicable to maintain ecosystem function and resiliency to climate change.	1.3.1: Develop and implement restoration protocols and techniques that promote ecosystem resilience and facilitate adaptation under a range of possible future conditions.
	1.3.2: Restore degraded habitats as appropriate to support a diversity of species assemblages and ecosystem structure and function.
	1.3.3: Restore/enhance areas that will provide essential habitat and ecosystem services during ecosystem transitions under a changing climate.
	1.3.4: Restore disturbance regimes as appropriate to emerging conditions, including instituting human-assisted disturbance where necessary (e.g., prescribed fire).
	1.3.5: Develop programs to encourage resilience through restoration of habitat features that provide natural buffers.

	1.3.6: Develop market-based incentives that encourage habitat restoration where appropriate.
Strategy 1.4: Conserve, restore, and as appropriate and practicable, establish new ecological connections among conservation areas to facilitate fish, wildlife, and plant migration, range shifts, and other transitions caused by climate change.	1.4.1: Identify species with special connectivity needs (i.e., those that are area-limited, resource-limited, dispersal-limited, or process-limited).
	1.4.2: Assess and prioritize critical connectivity gaps and needs across current conservation areas, including areas likely to serve as refugia in a changing climate.
	1.4.3: Conserve corridors and transitional habitats between ecosystem types through both traditional and non-traditional (e.g., land exchanges, rolling easements) approaches.
	1.4.4: Assess and take steps to reduce risks of facilitating movement of undesirable non-native species, pests, and pathogens.
	1.4.5: Assess existing physical barriers or structures that impede movement and dispersal within and among habitats to increase natural ecosystem resilience to climate change, and where necessary, consider the redesign or mitigation of these structures.
	1.4.6: Provide landowners and stakeholder groups with incentives for conservation and restoration of key corridor habitats through conservation programs such as those under the conservation title of the Farm Bill and landowner tools under the ESA as well as other mechanisms such as conservation easement tax incentive programs designed to protect private lands of high connectivity value under climate change.
Goal 2: Manage species and habitats to protect ecosystem functions and provide sustainable cultural, subsistence, recreational, and commercial use in a changing climate.	
Strategy 2.1: Update current or develop new species, habitat, and land and water management plans, programs and practices to consider climate change and support adaptation.	2.1.1: Incorporate climate change considerations into new and future revisions of species and area management plans (e.g., North American Waterfowl Management Plan, National Forest Plans, State Wildlife Action Plans, and agency-specific climate change adaptation plans such as federal agency adaptation plans required by E.O. 13514) using the best available science regarding projected climate changes and trends, vulnerability and risk assessments, scenario planning, and other appropriate tools as necessary.
	2.1.2: Develop and implement best management practices to support habitat resilience in a changing climate.
	2.1.3: Identify species and habitats particularly vulnerable to transition under climate change (e.g., wetlands, cool-water to warm-water fisheries, or cool season to warm season grasslands) and develop management strategies and approaches for adaptation.
	2.1.4: Review and revise as necessary techniques to maintain or mimic natural disturbance regimes and to protect vulnerable habitats consistent with emerging conditions.
	2.1.5: Review and revise as necessary existing species and habitat impact avoidance, minimization, mitigation, and compensation standards and develop new standards as necessary to address impacts in a manner that incorporates climate change considerations.
	2.1.6: Review permitting intervals in light of the scope and pace of climate change impacts.
	2.1.7: Review existing management frameworks and identify ways to increase the ability of stakeholders to adapt their actions to climate variability and change while preserving the integrity and sustainability of natural resources, habitats, and ecosystems.
	2.1.8: Utilize the principles of ecosystem based management and green infrastructure.
	2.1.9: Develop strategic protection, retreat, and abandonment plans for areas currently experiencing rapid climate change impacts (e.g., coastline of Alaska and low-lying islands).
Strategy 2.2: Develop and apply species-specific management approaches	2.2.1: Use vulnerability and risk assessments to design and implement management actions at species to ecosystem scales.
	2.2.2: Develop criteria and guidelines that foster the appropriate use, and discourage inappropriate use of translocation, assisted relocation, and captive breeding as climate adaptation strategies.

to address critical climate change impacts where necessary.	2.2.3: Where appropriate, actively manage populations (e.g., using harvest limits, seasons, translocation, captive breeding, and supplementation) of vulnerable species to ensure sustainability and maintain biodiversity, human use, and other ecological functions.
Strategy 2.3: Conserve genetic diversity by protecting diverse populations and genetic material across the full range of species occurrences.	2.3.1: Develop and implement approaches for assessing and maximizing the potential for maintaining genetic diversity of plant and animal species.
	2.3.2: Protect and maintain high quality native seed sources including identifying areas for seed collection across elevational and latitudinal ranges of target species.
	2.3.3: Develop protocols for use of propagation techniques to rebuild abundance and genetic diversity for particularly at-risk plant and animal species.
	2.3.4: Seed bank, develop, and deploy as appropriate plant materials for restoration that will be resilient in response to climate change.
	2.3.5: Develop ex-situ living collections with partners such as botanic gardens, arboreta, zoos, and aquaria.
Goal 3: Enhance capacity for effective management in a changing climate.	
Strategy 3.1: Increase the climate change awareness and capacity of natural resource managers and other decision makers and enhance their professional abilities to design, implement, and evaluate fish, wildlife, and plant adaptation programs.	3.1.1: Build on existing needs assessments to identify gaps in climate change knowledge and technical capacity among natural resource professionals.
	3.1.2: Build on existing training courses and work with professional societies, academicians, technical experts, and natural resource agency training professionals to address key needs, augment adaptation training opportunities, and develop curricula, a common lexicon, and delivery systems for natural resource professionals and decision makers.
	3.1.3: Develop training on the use of existing and emerging tools for managing under uncertainty (e.g., vulnerability and risk assessments, scenario planning, decision support tools, and adaptive management).
	3.1.4: Develop a web-based clearinghouse of training opportunities and materials addressing climate change impacts on natural resource management.
	3.1.5: Encourage use of interagency personnel agreements and interagency (state, federal, and tribal) joint training programs as a way to disperse knowledge, share experience and develop interagency communities of practice about climate change adaptation.
	3.1.6: Support and enhance web-based clearinghouses of information (e.g., www.CAKEX.org, etc.) on climate change adaptation strategies and actions targeted towards the needs of resource managers and decision makers.
	3.1.7: Increase scientific and management capacity (e.g., botanical expertise) to develop management strategies to address impacts and changes to species.
	3.1.8: Develop training materials to help managers and decision makers apply climate knowledge to the administration of existing natural resource and environmental laws and policies.
Strategy 3.2: Facilitate a coordinated response to climate change at landscape, regional, national, and international scales across state,	3.2.1: Use regional venues, such as LCCs, to collaborate across jurisdictions and develop conservation goals and landscape/seascape scale plans capable of sustaining fish, wildlife, and plants.
	3.2.2: Identify and address conflicting management objectives within and among federal, state, and tribal conservation agencies and private landowners, and seek to align policies and approaches wherever possible.
	3.2.3: Integrate individual agency and state climate change adaptation programs and State Wildlife Action Plans with other regional conservation efforts, such as LCCs, to foster collaboration.

federal, and tribal natural resource agencies and private conservation organizations.	3.2.4: Collaborate with tribal governments and native peoples to integrate traditional ecological knowledge and principles into climate adaptation plans and decision-making.
	3.2.5: Engage with international neighbors, including Canada, Mexico, Russia, and nations in the Caribbean Basin, Arctic Circle, and Pacific Ocean to help adapt to and mitigate climate change impacts in shared trans-boundary areas and for common migratory species.
	3.2.6: Foster interaction among landowners, local experts, and specialists to identify opportunities for adaptation and to share resources and expertise that otherwise would not be available to many small landowners.
Strategy 3.3: Review existing federal, state and tribal legal, regulatory and policy frameworks that provide the jurisdictional framework for conservation of fish, wildlife, and plants to identify opportunities to improve, where appropriate, their usefulness to address climate change impacts.	3.3.1: Review existing legal, regulatory and policy frameworks that govern protection and restoration of habitats and identify opportunities to incorporate the value of ecosystem services and improve, where appropriate, the utility of these frameworks to address climate change impacts.
	3.3.2: Review existing legal, regulatory and policy frameworks and identify opportunities to develop or enhance, where appropriate, market-based incentives to support restoration of habitats and ecosystem services impacted by climate change. Identify opportunities to eliminate disincentives to conservation and adaptation.
	3.3.3: Review existing legal, regulatory and policy frameworks and identify opportunities to improve, where appropriate, compensatory mitigation requirements to account for climate change.
	3.3.4: Review existing legal, regulatory and policy frameworks that govern floodplain mapping, flood insurance, and flood mitigation and identify opportunities to improve their usefulness to reduce risks and increase adaptation of natural resources and communities in a changing climate.
	3.3.5: Review existing legal, regulatory and policy tools that provide the jurisdictional framework for conservation of fish, wildlife, and plants to identify existing provisions that provide climate change adaptation benefits.
	3.3.6: Continue the ongoing work of the Joint State-Federal Task Force on Endangered Species Act Policy to ensure that policies guiding implementation of the ESA provide appropriate flexibility to address climate change impacts on listed fish, wildlife, and plants and to integrate the efforts of federal, state, and tribal agencies to conserve listed species.
	3.3.7: Initiate a dialogue among all affected interests about opportunities to improve the usefulness of existing legal, regulatory, and policy frameworks to address impacts of sea level rise on coastal habitats.
Strategy 3.4: Optimize use of existing fish, wildlife, and plant conservation funding sources to design, deliver, and evaluate climate adaptation programs.	3.4.1: Prioritize funding for land and water protection programs that incorporate climate change considerations.
	3.4.2: Review existing federal, state, and tribal grant programs and revise as necessary to support funding of climate change adaptation and include climate change considerations in the evaluation and ranking process of grant selection and awards.
	3.4.3: Collaborate with state and tribal agencies and private conservation partners to sustain authorization and appropriations for the State and Tribal Wildlife Grants Program and include climate change criteria in grant review process.
	3.4.4: Collaborate with agricultural interests and businesses to identify potential impacts of climate change on crop production and identify conservation strategies that will maintain or improve ecosystem services through programs under the conservation title of the Farm Bill or other vehicles.
	3.4.5: Review existing conservation related federal grants to tribal agencies and revise as necessary to provide funding for tribal climate adaptation activities.
	3.4.6: Develop a web-based clearinghouse of funding opportunities available to support climate adaptation efforts.

Goal 4: Support adaptive management in a changing climate through integrated observation and monitoring and use of decision support tools.	
Strategy 4.1: Support, coordinate, and where necessary develop distributed but integrated inventory, monitoring, observation, and information systems at multiple scales to detect and describe climate impacts on fish, wildlife, plants, and ecosystems.	4.1.1: Synthesize existing observations, monitoring, assessment, and decision support tools as summarized by the U.S. Global Change Research Program Ecosystem Working Group. Conduct a knowledge-gap analysis of existing observation networks, indicators, monitoring programs, remote sensing capabilities, and geospatial data necessary to define priorities.
	4.1.10: Identify and develop a lessons learned/success stories list of multi-partner data development, analysis, and dissemination efforts.
	4.1.2: Use available long-term monitoring programs at appropriate scales (local to international) as baselines for population and migration changes that could be affected by climate change (e.g., International Waterfowl Surveys).
	4.1.3: Work through existing distributed efforts (e.g., NCA, National Estuarine Research Reserve System's system-wide monitoring program, State Natural Heritage Programs, National Wildlife Refuge System and National Park Service inventory and monitoring programs) to support integrated national observation and information systems that inform climate adaptation.
	4.1.4: Expand and develop as necessary a network of sentinel sites (e.g., tribal lands, National Estuarine Research Reserves, and National Wildlife Refuges) for integrated climate change inventory, monitoring, research, and education.
	4.1.5: Develop consensus standards and protocols that enable multi-partner use and data discovery, as well as interoperability of databases and analysis tools related to fish, wildlife, and plant observation, inventory, and monitoring.
	4.1.6: Develop, refine, and implement monitoring protocols that provide key information needed for managing and conserving species and ecosystems in a changing climate.
	4.1.7: Use existing or define new indicators at appropriate scales that can be used to monitor the response of fish, wildlife, plants, and ecosystems to climate change.
	4.1.8: Promote a collaborative approach to acquire, process, archive, and disseminate essential geospatial and satellite-based remote sensing data products (e.g., snow cover, green-up, surface water, wetlands) needed for regional-scale monitoring and land management.
	4.1.9: Collaborate with the National Phenology Network to facilitate monitoring of phenology; create an analogous National Population Network to catalog changes in distribution and abundance of fish, wildlife, and plants that have been identified as most vulnerable to climate change.
Strategy 4.2: Identify, develop, and employ decision support tools for managing under uncertainty (e.g., vulnerability and risk assessments, scenario planning, strategic habitat conservation approaches, forecasting, and adaptive management evaluation systems) via dialogue with scientists, managers (of	4.2.1: Develop regional downscaling of Global Climate models to conduct vulnerability assessments of living resources.
	4.2.2: Develop, disseminate, and utilize geophysical and biological modeling (such as Species Distribution Models).
	4.2.3: Conduct vulnerability and risk assessments for habitats and priority species (threatened and endangered species, species of greatest conservation need, and species of socioeconomic and cultural significance).
	4.2.4: Define national standards and criteria to identify fish, wildlife, plants, and ecosystems most vulnerable to climate change impacts.
	4.2.5: Synthesize vulnerability assessments across jurisdictions to provide regional assessments.
	4.2.6: Engage scientists, resource managers, economists, and stakeholders in climate change scenario planning processes, including identification of a set of plausible future scenarios associated with climate phenomena and socioeconomics likely to significantly impact fish, wildlife, and plants.
	4.2.7: Ensure the availability of and provide guidance for decision support tools (e.g., NOAA's Digital Coast, Sea Level Affecting Marshes Model (SLAMM), etc.) that assist federal, state, local, and tribal resource managers and planners in effectively managing fish, wildlife, and plants in a changing climate.

natural resources and other sectors), economists, and stakeholders.	4.2.8: Use observation and monitoring systems in an adaptive management framework to evaluate the effectiveness of specific management actions and adapt management approaches appropriately.
	4.2.9: Develop a central repository for sharing experiences and reporting progress in implementing the Strategy in order to share information across implementing agencies and partners and to inform future iterations of the Strategy.
Goal 5: Increase knowledge and information on impacts and responses of fish, wildlife, and plants to a changing climate.	
Strategy 5.1: Identify knowledge gaps and define research priorities via a collaborative process among federal, state, tribal, private conservation organization, and academic resource managers and research scientists.	5.1.1: Increase coordination and communication between resource managers and natural and social scientists through existing forums (e.g., National Science Foundation (NSF), USGCRP, NCA, USDA, Cooperative Ecosystem Studies Units, CSCs, LCCs, JVs, RISAs, Associations of Fish and Wildlife Agencies, State Wetlands Managers, State Floodplain Managers, Coastal States Organization, National Estuarine Research Reserve Association, and others) to ensure research is connected to management needs.
	5.1.2: Bring managers and scientists together at the appropriate scales to prioritize research needs that address resource management objectives considering a changing climate.
	5.1.3: Encourage agencies with scientific assets and expertise to participate in and contribute to regional dialogues about actions needed to meet management-driven science needs.
	5.1.4: Participate in research planning for relevant programs of agencies (e.g., NSF, NOAA, state agencies, and local governments), and intergovernmental forums (e.g., Conservation of Arctic Flora and Fauna working group of the Arctic Council) to ensure inclusion of research relevant to missions of agencies and resource managers.
	5.1.5: Based on priority conservation needs identified by resource managers, develop national, and as appropriate, regional research agendas identifying key high level questions for which more fundamental research is needed to enable development of management applications or decision support tools; and facilitate consultation among major science funding agencies to maximize incorporation of these needs into funding opportunities and work plans.
	5.1.6: Prioritize research on questions relevant to managers of near-term risk environments (e.g., low-lying islands, alpine systems and high-elevation headwaters, coral reefs, and glaciated areas) or highly vulnerable species.
	5.1.7: Prioritize research and methods development for the valuation of ecosystem services and the role these services play in ameliorating climate change impacts on people and communities.
Strategy 5.2: Conduct research into ecological aspects of climate change, including likely impacts and the adaptive capacity of species, communities and ecosystems, and their associated ecosystem services, working through existing partnerships or new collaborations as	5.2.1: Produce regional to subregional projections of future climate change impacts on physical, chemical, and biological conditions for U.S. ecosystems.
	5.2.2: Support basic research on life histories and food web dynamics of fish, wildlife, and plants to increase understanding of how species are likely to respond to changing climate conditions and identify survival thresholds.
	5.2.3: Identify and address priority climate change knowledge gaps and needs (e.g., species adaptive capacity, risk and rewards of assisted relocation, climate change synergy with existing stressors).
	5.2.4: Conduct research on the propagation and production of native plant materials to identify species or genotypes that may be resilient to climate change.
	5.2.5: Accelerate research on establishing the value of ecosystem services and potential impacts to communities from climate change (e.g., loss of pollution abatement or flood attenuation; climate regulation by forests and wetlands through carbon sequestration, oxygen production, and CO2 consumption; and pollination by insects, birds, and mammals).

needed (e.g., USGCRP, NCA, CSCs, RISAs, and others).	5.2.6: Identify pollutants likely to be affected by climate change and accelerate research on their effects on fish, wildlife, and their habitats, including contaminant effects that will likely increase vulnerability to climate change.
Strategy 5.3: Advance understanding of climate change impacts and species and ecosystem responses through modeling.	5.3.1: Define the suite of physical and biological variables and ecological processes for which predictive models are needed via a collaborative process among state, federal, and tribal resource managers, scientists, and model developers.
	5.3.2: Improve modeling of climate change impacts on vulnerable species, including projected future distributions and the probability of persistence.
	5.3.3: Develop models that integrate the potential effects of climate and non-climate stressors on vulnerable species.
	5.3.4: Develop and use models of climate impacted physical and biological variables and ecological processes at temporal and spatial scales relevant for conservation.
	5.3.5: Provide access to current climate data and ensure alignment with data management and decision support tools at agency and departmental levels.
Goal 6: Increase awareness and motivate action to safeguard fish, wildlife, and plants in a changing climate.	
Strategy 6.1: Increase public awareness and understanding of climate impacts to natural resources and ecosystem services and the principles of climate adaptation at regionally and culturally-appropriate scales.	6.1.1: Develop focused outreach efforts and materials aimed at local, state, tribal, and federal government authorities; land and water managers; economic policy decision makers; zoning and transportation officials; etc. on ecosystem services, climate impacts to fish, wildlife, plants, and ecosystems, the impacts of other local stressors, and the importance of adaptation planning.
	6.1.2: Develop outreach efforts and materials to other key audiences, such as the private sector (e.g., agriculture, forestry, etc.), cultural leaders, and private land managers that provide information on existing conservation incentive programs.
	6.1.3: Identify and partner with key stakeholder groups (e.g., conservation and environmental organizations, hunting and angling groups, trade associations, outdoor manufacturers and retailers) to help develop and distribute key climate change and adaptation messages tailored for their interest groups as well as the broader public.
	6.1.4: Incorporate information about potential climate change impacts to ecosystem services in education and outreach activities.
	6.1.5: Increase public awareness of existing habitat conditions and the benefits of building resiliency of those habitats.
Strategy 6.2: Engage the public through targeted education and outreach efforts and stewardship opportunities.	6.2.1: Identify and make opportunities available for public involvement to aid in the development of focused outreach materials.
	6.2.2: Use public access points, nature centers, and hunting and fishing regulation guides to inform tourists, visitors, and recreational users of climate change impacts to and adaptation strategies for fish, wildlife, and plants.
	6.2.3: Develop specific programs and/or modify existing programs (e.g., bird and amphibian surveys) to motivate action and engage citizens in monitoring impacts of climate change on the landscape (e.g., citizen science monitoring for detection of invasive species, nature center programs, etc.).
	6.2.4: Make research and monitoring information regarding climate impacts to species and natural systems accessible and easily understood to the public and other partners (e.g., commercial fisheries, etc.).
	6.2.5: Develop educational materials and teacher trainings for K-12 classrooms linked to state education standards on impacts and responses to climate change.
	6.2.6: Develop collaborations with zoos, museums, aquariums, botanic gardens, arboreta, and other organizations and universities to increase communication and awareness of impacts and responses to climate change.

	6.2.7: Develop core messaging and recommended strategies to communicate the Strategy within participating organizations, local associations and clubs (e.g., garden clubs), and with the public.
	6.2.8: Develop strategy to assess effectiveness of communication efforts and modify as appropriate.
Strategy 6.3: Coordinate climate change communication efforts across jurisdictions.	6.3.1: Develop, implement, and strengthen existing communication efforts between federal agencies, with states and tribes to increase awareness of the impacts and responses to climate change.
	6.3.2: Engage employees from multiple agencies in key climate change issues by expanding existing forums for information sharing and idea exchange, and create new forums and channels as needed.
	6.3.3: Provide access to tools (web-based and others) that promote improved collaboration, interactive dialog, and resource sharing to minimize duplication of effort across jurisdictions.
Goal 7: Reduce non-climate stressors to help fish, wildlife, plants, and ecosystems adapt to a changing climate.	
Strategy 7.1: Slow and reverse habitat loss and fragmentation.	7.1.1: Work with local land-use planners, flood-plain administrators, and others to identify shared interests and potential conflicts in reducing and reversing habitat fragmentation and loss through established planning and zoning processes.
	7.1.2: Work with farmers and ranchers to apply the incentive programs in the conservation title of the Farm Bill as well as the landowner tools under the ESA and other programs to minimize conversion of habitats, restore marginal agricultural lands to habitat, and increase riparian buffer zones.
	7.1.3: Provide landowners with appropriate incentives for conservation and restoration of key habitats, such as conservation easement tax incentive programs, designed to protect private lands of high habitat connectivity value under climate change.
	7.1.4: Work with water resource managers to enhance design and siting criteria for water resources infrastructure to reduce impacts and restore connectivity in floodplains and aquatic habitats.
	7.1.5: Work with local and regional water management agencies to evaluate historical water quantities and base flows and develop water management options to protect or restore aquatic habitats.
	7.1.6: Consider application of offsite habitat banking linked to climate change habitat priorities as a tool to compensate for unavoidable onsite impacts and to promote habitat conservation or restoration in desirable locations.
	7.1.7: Consider market-based incentives that encourage conservation and restoration of ecosystems for the full range of ecosystem services including carbon storage.
	7.1.8: Minimize impacts from alternative energy development by focusing siting options on already disturbed or degraded areas.
	7.1.9: Identify options for redesign and removal of existing structures or barriers where there is the greatest potential to restore natural processes.
Strategy 7.2: Slow, mitigate, and reverse where feasible ecosystem degradation from anthropogenic sources through land/ocean- use	7.2.1: Work with local and regional land-use, water resource, and coastal and marine spatial planners to identify potentially conflicting needs and opportunities to minimize ecosystem degradation resulting from development and land and water use.
	7.2.10: Develop and implement protocols for considering carbon sequestration and storage services of natural habitats in management decisions.
	7.2.11: Incorporate the recommendations and actions from the National Action Plan for Managing Freshwater Resources in a Changing Climate into water resource planning.

planning, water resource planning, pollution abatement, and the implementation of best management practices.	7.2.12: Consider the impact of logging practices on fire risk and ecosystem diversity and function.
	7.2.2: Work with farmers and ranchers to develop and implement livestock management practices to reduce and reverse habitat degradation and to protect regeneration of vegetation.
	7.2.3: Reduce existing pollution and contaminants and increase monitoring of air and water pollution as necessary.
	7.2.4: Work with water resource managers to identify, upgrade, or remove outdated sewer and stormwater infrastructure to reduce water contamination.
	7.2.5: Increase restoration, enhancement, and conservation of riparian zones and buffers in agricultural and urban areas to minimize non-point source pollution.
	7.2.6: Work with federal, state, and tribal environmental regulators to address potential pollution threats, including impairments to water quality.
	7.2.7: Reduce impacts of impervious surfaces and stormwater runoff in urban areas to improve water quality, groundwater recharge, and hydrologic function.
	7.2.8: Reduce ground and surface water withdrawals in areas experiencing drought and/or increased evapotranspiration.
	7.2.9: Promote water conservation, reduce water use, and promote increased water quality via proper waste disposal.
Strategy 7.3: Use, evaluate, and as necessary, improve existing programs to prevent, control, and eradicate invasive species and manage pathogens.	7.3.1: Use, integrate, and implement existing pest and pathogen risk assessment methodologies for imported organisms and establish appropriate regulations to prevent deliberate importations of pests, pathogens, or other species that are predicted to be harmful or invasive.
	7.3.2: Employ a multiple barriers approach to detect and contain incoming and established invasive species, including monitoring at points of origin and points of entry for shipments of goods and materials into the United States and for trans-shipment within the country. Utilize education, regulation, and risk management tools (e.g., the Hazard Analysis and Critical Control Point process).
	7.3.3: Develop national standards for collecting and reporting invasive species data to facilitate information sharing and management response.
	7.3.4: Apply risk assessment and scenario planning to identify actions and prioritize responses to invasive species that pose the greatest threats to natural ecosystems.
	7.3.5: Implement existing national, state and local strategies and programs for rapid response to contain, control, or eradicate invasive species, and develop new strategies as needed.
	7.3.6: Assess risks and vulnerability to identify high priority areas and/or species for monitoring of invasive species and success of control methods.
	7.3.7: Monitor invasive species and pathogens associated with fish, wildlife, and plant species for increased understanding of distributions and to minimize introductions.
	7.3.8: Apply integrated management practices, share innovative control methodologies, and take corrective actions when necessary to manage fish, wildlife, and plant diseases and invasives.
	7.3.9: Work with federal, state, regional, and county agricultural interests to identify potentially conflicting needs and opportunities to minimize ecosystem degradation resulting from pests, pathogens, and invasive species eradication, suppression, and control efforts.

Strategy 7.4: Reduce destructive capture practices (e.g., fisheries bycatch, destructive fishing gear), over-harvesting and illegal trade to help increase fish, wildlife, and plant adaptation.	7.4.1: Reduce the unintentional capture (such as fisheries bycatch) of species in fishing and other capture activities.
	7.4.2: Implement the 2011 U.S. National Bycatch Report recommendations (NMFS 2011) to increase information of bycatch levels, identify fisheries and/or species with potential bycatch concerns, and improve monitoring of bycatch levels over time.
	7.4.3: Reduce negative impacts of capture practices and gear on important habitats for fish, wildlife, and plants.
	7.4.4: Determine sustainable harvest levels in changing climate, and design, implement, and evaluate management plans and practices to eliminate over-harvest of fish, wildlife, and plants.
	7.4.5: Increase efforts to monitor and reduce illegal species trade in the United States.

Appendix II: Adaptation Strategies for other sectors also benefiting natural resources
Agriculture
Encourage producers to take sensitive lands out of crop production for extended periods of time and restore wildlife habitat on these lands.
Encourage producers to maintain grassland habitat.» » Encourage producers to adopt agricultural production and land use strategies that are resilient under changing conditions and that benefit agriculture, fish, and wildlife.
Improve estimates of ecosystem services to better link conservation compensation with the environmental services producers provide.
Encourage producers to adopt wildlife-friendly practices.
Energy Development
Increase consultation and better align natural resource management and energy sector climate change adaptation strategies and activities, including vulnerability assessments.
Incentivize the siting of new large energy projects in previously disturbed areas or areas that have the least impact to fish, wildlife, and plants. Avoid areas of high ecological vulnerability and areas with limited water availability and competing water demands.
Research and develop energy technologies that minimize climate change impacts to fish, wildlife, and plants.
Use local and regionally appropriate approaches that incorporate adaptive management principals to develop and site renewable energy resources to reduce vulnerability and enhance the resilience of local and regional ecosystems.
Community Planning
Provide opportunities to engage many different stakeholders in land use and resource use decisions that incorporate climate change considerations.
Anticipate changes in human demographic patterns in response to climate change, identify potential conflicts with the protection of fish, wildlife, and plants, and develop possible solutions.
Continue current research on the valuation of ecosystem services so that communities can make better- informed decisions regarding land use and resource protection.
Educate the public about ecosystems, ecosystem services, and anticipated climate changes, and prepare the public for projected changes.
Develop multi-objective strategies to identify landscapes which sustain ecological values and provide human benefits through ecosystem services (e.g., urban green space which provides recreational and cooling values; restoration of native habitats and species; and promotion of native and drought tolerant species in development standards).
Provide tools and methods that encourage communities to analyze the potential costs and benefits of adaptation

strategies (i.e., fortify, accommodate, relocate) and their impact on surrounding habitats.
Incorporate habitat migration potential into land-use planning and protect key corridors for species movement.
Review federal programs to encourage buyouts and other mitigation measures in areas vulnerable to recurring climate change impacts.
Transportation
Strengthen interagency and stakeholder cooperation and coordination, particularly between transportation and natural resource planners and managers.
Identify changing transportation demands resulting from climate change and the implications to infrastructure development.
Use the best available habitat conservation plans to develop strategies associated with transportation projects that take into account climate change impacts to habitats and species.
Develop best management practices (BMPs) and best designs for transportation projects to accommodate climate change effects and incorporate conservation needs at the same time.
Water Resource Management
Establish a planning process that includes multiple levels of government, prioritization of challenges, and considerations for other resources.
Improve water resources and climate change information for decision- making to help move decisions beyond a reliance on past conditions.
Strengthen assessment of vulnerability of water resources to climate change.
Expand water use efficiency, conservation, productivity, and substitution to reduce overall demand of water.
Support integrated water resources management through coordinated adaptive management.
Support training and outreach to build response capability using cross-disciplinary education, instruction, and training while focusing on solutions integrated across multiple sectors.